AGU FALL MEETING
San Francisco | 15–19 December 2014

GC52B-01: Reconstitution of a Continuous Climatic and Rainfall Series for the Central Sahel (1950-2012): Data, Methodology and Application

Friday, 19 December 2014
10:20 AM - 10:35 AM
Moscone West - 3003

The Sahel is one of the regions in the world which has experienced the strongest climatic changes in the past decades. In a context of high population growth and mainly agriculture-based economies and livelihoods, these fluctuations can cause serious societal problems. Understanding past and predicting future climatic changes and their implications on natural and cultivated ecosystems are hence primordial. Modelling efforts in the fields of hydrology and ecohydrology have already been undertaken, but are hindered by data availability as soon as the multi-decadal time scale is targeted. Indeed, in addition to being scarce, climatic data are often discontinuous in time, limiting the use of many modelling tools.

In this study we produced a continuous and consistent data set at Niamey, Niger (13.5° N, 2.1° E) from 1950 to 2012 at different temporal scales (daily, 3-h and 30-min) that can be used as inputs in most LSM-type, vegetation and hydrological models. A stochastic component was introduced to reflect the uncertainty on the determination of missing data. Variables under study were: rainfall, air temperature, specific humidity, air pressure, wind speed, cloud cover, clear-sky longwave and shortwave radiation. Missing data were filled through regression methods, artificial neural networks, or by randomly selecting the missing variables from data classes presenting similar properties.

The datasets showed an increase in temperature of over 1°C since the 1950s. They also maintained the diurnal and seasonal cycles for all variables, thus verifying their internal coherence. Uncertainty at the sub-daily scale did not propagate at longer time-scales for the climatic data. Finally, trends in the seasonal and diurnal cycle of main variables were analyzed and were found coherent with published data. As an illustration of a possible use of this dataset, variations in the water and energy budgets for 1950-2012 for a major ecosystem in the region were simulated using a detailed LSM/SVAT model (SiSPAT). This dataset could be used by the community to better understand and predict land-surface-atmosphere interactions in Central Sahel, including hydrological ones, such as historical changes in yield, growth of natural vegetation, changes in the water cycle and as a high-quality baseline for climate change impacts studies.

Authors

Jerome Demarty
IRD Hydrosciences

Crystele Leauthaud *
CNRS, Hydrosciences

Bernard Cappelaere
IRD Hydrosciences

Theo Vischel
CNRS-INSU, IGE

Françoise Guichard
CNRM

Laurent Kergoat
GET Géosciences Environnement Toulouse

Grippa Manuela
GET Géosciences Environnement Toulouse

Frédéric Hourdin
LMD/IPSL/CNRS/UPMC

Benjamin Sultan
IRD-LOCEAN

Find Similar

View Related Events

Day: Friday, 19 December 2014